

Adaptive Gridding in Parallel with the SPARTA DSMC Code

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SPARTA [1] is a relatively new parallel DSMC [2] code which uses hierarchical Cartesian grids cut by embedded triangulated surfaces. We have recently added an adaptive grid capability, which can be used either between successive simulation runs, or to perform on-the-fly adaptation as a flow field around a body develops. It works by refining or coarsening grid cells based on geometric criteria, such as nearness to downwind surface elements, or flow criteria, such as the number of particles per cell or mean-free-path versus cell size (see Figure 1). I will discuss algorithmic issues related to adapting a distributed grid in parallel, including communication and load-balancing ideas. I will also present performance data for how well such operations scale to large grids and machines.

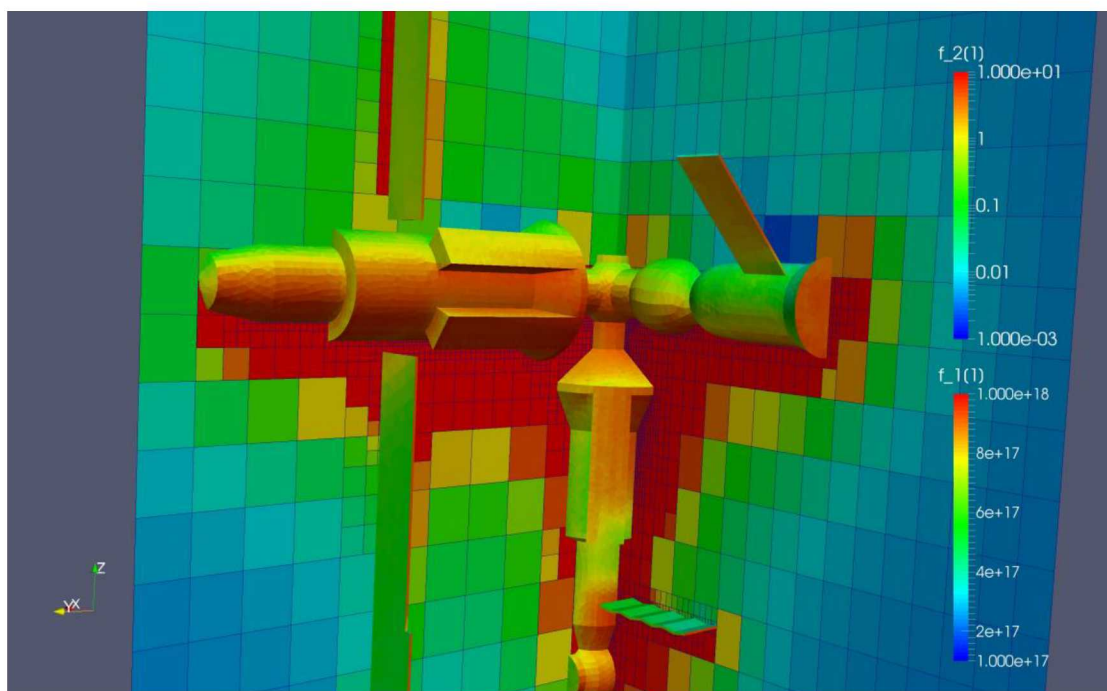


Figure 1. Mesh adaptation based on geometry of object and particles per cell.

- [1] S. J. Plimpton and M. A. Gallis, "SPARTA Direct Simulation Monte Carlo Simulator," <http://sparta.sandia.gov/> Sandia National Laboratories, Albuquerque, NM (2015).
- [2] G. A. Bird, *Molecular Gas Dynamics and the Direct Simulation of Gas Flows*, Oxford University Press, Oxford, UK (1994).

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